

LED LUMINAIRES: THE TIME IS RIGHT TO MAKE THE SWITCH

By Thor Scordelis & Steve Landau, Xicato

While some may still consider light emitting diodes (LEDs) a relatively “new” lighting technology, many LED installations have been operating successfully for more than five years. As a result, we know enough about the operation of LEDs in lighting to be certain that, implemented well in a purpose-built luminaire, they reliably offer high light quality over long lifetimes while consuming low amounts of energy.

But, you may ask, why go to the “trouble” of purchasing purpose-built luminaires? If you’re looking to make the switch to LEDs from incandescent lighting, why not opt for the seemingly quick fix of simply replacing conventional lamps with LED bulbs? After all, LED replacement lamps are now widely available in a range of standard formats, and typically consume much less energy than the incandescent lamps they replace.

Here’s the catch: while they *can* save significant energy, LED replacement lamps’ performance over their rated lifetime is often poor, as the quality of light they produce degrades perceptibly. It may seem reasonable to assume that a solution rated for 50,000 hours of use will perform in exactly the same way on the 50,000th hour as on the day it was installed – that it will look just the same to the human eye – but that could prove problematic.

In fact, mounting anecdotal evidence from lighting designers and specifiers suggests that, in some installations, LED replacement lamps fail to live up to their manufacturers’ lifetime claims of 35,000 hours or longer. The evidence is scientific, as well – recent studies made on behalf of the U.S. Department of Energy^{1, 2} have revealed installations in which LED replacement lamps have:

- Displayed highly visible color shifts after as few as 4,000 hours of use
- Displayed unwanted behavior such as visible flickering
- Suffered from accelerated rates of lumen depreciation

Don’t let any of this scare you away from implementing an LED lighting strategy – you just need to pick the right one. Let’s look at why well-designed LED luminaires are a far superior choice compared to LED replacement bulbs for many professional settings.

The Key Is True, Consistent Color

In professional applications, stability of color temperature and intensity of light are of critical importance. In retail environments, for example, color tones are carefully specified to match the merchandise on display; a color shift can weaken customer appeal and lower sales. In hospitality and restaurant environments, lighting schemes are designed to make the right first impression and to make people comfortable. And in museums and galleries, color tones are selected precisely to complement the objects on display.

These settings demand an LED lighting scheme that delivers the best possible quality of light – true, consistent color over time, with no flickering or degradation and a minimal risk of failure. Merely replacing conventional bulbs with LED bulbs is undesirable on all of these counts. First, visible flicker with LED replacement lamps is not uncommon and often a result of incompatible dimming systems. Second, many professional settings require “always on” lighting, which can create thermal challenges with LED replacement bulbs. The waste heat generated by white LEDs in normal operation can rapidly degrade or even destroy the internal electronics as well as the LED and its phosphor coating (which converts the LED’s native blue color to white) unless it’s properly

channeled away from the bulb. In a purpose-built LED luminaire, a fixture's thermal design is specified to support continuous operation without heat damage.

Thus, to achieve the desired results, the luminaire must exhibit both consistency and reliability. Consistent light output maintains a stable color temperature, intensity (measured in lumens), color rendering capability and beam pattern over the rated lifetime of the luminaire. And for a luminaire to be considered reliable, it must operate for its rated lifetime without failing and without exhibiting undesired behavior such as flickering or visible dark spots in the light source.

This brings us to the light source itself. The color stability of the luminaire is affected most strongly by the color stability of the LED light source. While poor thermal management and degraded optics can cause color shift, if the LED light source is not color-stable in the first place, no other element of the luminaire can overcome this issue.

The global lighting industry does not yet have a framework for predicting color stability over time, but many luminaire manufacturers follow the lead set by Xicato. Xicato designs its LED modules from the ground up for stability and quality³. Thermal testing and validation regimes ensure that heat can be properly managed to extend lifetimes and performance. Its breakthrough technologies enable LED modules that deliver the best possible light without fail, to make quality of light available to everyone.

As we have seen, many problems that users have experienced with LED lighting could have been avoided by installing LED luminaires designed for the specific application instead of merely switching out incandescent bulbs for LED bulbs. To ensure success in moving to LED luminaires, you must decide the quality and intensity of light necessary for your application, and then pick the right luminaire to meet these requirements.

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References:

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